EDITED BY GILBERT CHIN AND JAKE YESTON

ECOLOGY

Ocean Sanctuaries

The existence of hot spots of high biodiversity has been well documented on land and also in a few marine habitats—for instance, on coral reefs and at deep-sea vents. However, the patterns of biodiversity in pelagic ocean habitats have been harder to discern. Seamounts—mountains that rise from the ocean floor but whose summits lie well below the surface—are known to aggregate migrating pelagic fish species, but a catalog of their intrinsic biodiversity is not yet available, largely because open-ocean data have been gathered at too coarse a scale. Using records from long-line fisheries in the western and central Pacific Ocean, Morato *et al.* modeled and mapped the occurrences of pelagic fish species in relation to seamounts. They observed a consistent pattern of higher diversity on and around seamounts, a pattern that can be detected as far away as 30 to 40 km from the summit of a seamount; in contrast, this pattern is not seen at similar distances from shorelines. An underlying cause of this increased diversity may be the greater vertical movement and mixing of nutrients in the neighborhood of seamounts. Another contributing factor may be the seamount magnetic signatures, which are used as navigational aids by migrant species. These findings suggest that seamounts would be good candidates for the establishment of offshore open-ocean conservation areas. — AMS

Proc. Natl. Acad. Sci. U.S.A. **107**, 10.1073/pnas0910290107 (2010).

CELL BIOLOGY

Breaking Out

The basement membrane is a dense extracellular meshwork of collagens, glycoproteins, and proteoglycans that surrounds most tissues in metazoans, providing structural support and regulating cell function. It acts as a barrier to the passive diffusion of molecules larger than 50 nm, but some cells possess the ability to cross the basement membrane, which is important during development, when new tissues are being formed, and during wound healing. Metastasis of epithelial tumors, which often is lethal, also requires the tumor cells first to cross a basement membrane in order to enter the blood or lymphatic vessels and thence to spread to distal sites. Thus, understanding how cell invasion occurs in vivo is important for understanding both development and disease.

During *Caenorhabditis elegans* larval development, anchor cells initiate uterine-vulval contact in response to cues from underlying vulval precursor cells by breaching the obstructing basement membrane. Matus *et al.* have combined this in vivo model system with a comprehensive RNAi screen to identify 99 genes involved in cell invasion, some of which were already known to be involved, as well as genes not previously linked to this process. Follow-up analysis of a subset of genes revealed roles in distinct stages of invasion, including the establishment of the specialized invasive membrane in the invading cell and the removal of basement membrane. Many of these genes are conserved in humans, and two of them were found to be required for the invasion of human breast and colon cancer cells in an ex vivo model, and are thus potential targets for limiting cancer metastasis. — HP

Sci. Signal. **3**, ra35 (2010).

GEOCHEMISTRY

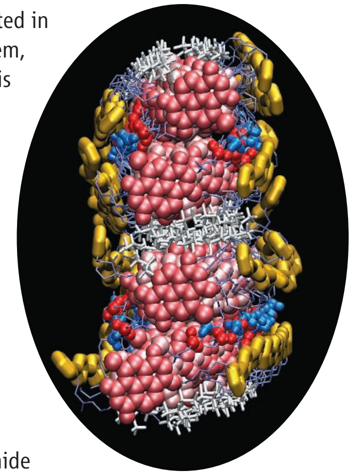
Iron's Icy Fate

The scarcity of bioavailable iron [$Fe(II)_{aq}$] in the oceans limits primary productivity. In most marine environments, $Fe(II)_{aq}$ becomes available to phytoplankton only upon the reduction of Fe(III)-oxide particles added to the ocean from wind-blown dust or river outflows; however, in polar settings, a substantial fraction of iron is trapped in ice or snow before it enters the water column. Through a series of laboratory experiments and outdoor observations in Arctic ice, Kim *et al.* show that Fe(III) oxides in ice actually generate more $Fe(II)_{aq}$ than particles added directly to open water do. This process occurs through enhanced photoreductive dissolution of concentrated Fe(III) oxides at liquid-like ice grain boundaries, even in the presence of oxygen. When aggregated in a confined space, the semiconducting particles facilitate charge transfer much more rapidly than is possible for single particles in suspension. Therefore, Fe(III) oxides in ice or snow may ultimately contribute more to the bioavailable $Fe(II)_{aq}$ pool after melting than previously expected. — NW

Environ. Sci. Technol. **44**, 10.1021/es9037808(2010).

CHEMISTRY

Zipping Up and Down



In general, the first step in deriving electricity from sunlight is to liberate bound charges for current flow. Once such charges are generated in a photovoltaic system, the next challenge is to insure that the carriers separate and travel all the way to electrodes for collection, rather than unproductively recombining in place. Sakai *et al.* report the stepwise assembly of units consisting of naphthalenediimide chromophores (tuned in gap energy to create an electron transport gradient) attached to either *p*-oligophenyl hole donors or

Continued on page 1079

CREDITS (TOP TO BOTTOM): JORGE FONTES/IMAGDOP; N. SAKAI ET AL., J. AM. CHEM. SOC. **132**, 10.1021/JA101944R (2010)

Published by AAAS

Continued from page 1077

p-oligophenylethynyl hole acceptors. Sequential zipper assembly created stacks of several of these types of units on a gold substrate. Under irradiation with simulated solar emission, the photocurrents reached saturation at about 50 layers, indicating that long-distance carrier transport was achieved in this supramolecular construct. — PDS

J. Am. Chem. Soc. **132**, 10.1021/ja101944r (2010).

DEVELOPMENT

Ratcheting Toward Closure

During *Drosophila* embryogenesis, there are many movements and rearrangements of cells, leading ultimately to the formation of tissues and organs. One such major morphogenetic event involves the retraction of the germ band, leaving a hole in the embryo that must be covered. Epithelial cells from both sides pull themselves up over the underlying amnioserosal layer to cover the exposed tissue in a process called dorsal closure. Because of the genetic tractability of the fly, the molecular mechanics of this event can be elucidated.

Cables consisting of actin and nonmuscle myosin participate in dorsal closure, and David *et al.* have probed the mechanics of cable assembly and its regulation. Apical constriction of the amnioserosa is seen to involve cyclic assembly and disassembly of apical actomyosin networks. The phase of the cycle is regulated by several PAR cell-polarity proteins; PAR complexes localized to the apical domain of the amnioserosa transiently associate with the pulsing actomyosin network. Specifically, the polarity protein Bazooka is involved in the timing of the actomyosin pulse and Par-6 and aPKC govern the interpulse periods. This work shows how polarity factors regulate actomyosin dynamics during morphological change in the developing fly. — BAP

Development **137**, 1645 (2010).

EDUCATION

Get Them Talking

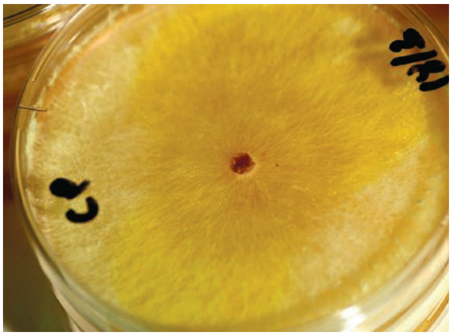
Science education reform efforts have stressed the exchange of ideas in the classroom. However, classroom discussions can be problematic because of the increasing abstraction of scientific concepts, lack of student motivation, and lack of student awareness of how to engage in discourse. To better understand how high-school biology teachers and students engage in discussion and whether embedded curricular supports are sufficient for promoting inquiry-based discussions, Alozie *et al.* designed and enacted support curriculum materials in two urban U.S. high schools for 9th- and 10th-graders studying molecular genetics. Data collection consisted mainly of observing classroom dynamics and analyzing videotaped sessions to find out which discourse patterns teachers used, what types of discussion ensued, and which participant—teacher or student—initiated discussion. Results showed that although teachers did increase their attempts to engage in inquiry-based discussion practices when using a support curriculum, they still came back to the traditional pedagogy of telling, rather than encouraging classroom interactions, demonstrating that the curricular supports provided were not sufficient to shift the teachers' style. — MM

Sci. Educ. **94**, 395 (2010).

BIOTECHNOLOGY

Fungal Assistance

Concerns about global warming associated with fossil fuel combustion have spurred great interest in developing alternative fuel



CREDIT: R. J. MURPHY

feedstocks from renewable biomass. In order to produce liquid fuels and commodity chemical compounds from biomass, it is necessary to break down polymeric cellulose into its constituent six-carbon sugar building blocks. The cellulose in wood is mixed thoroughly with other materials (lignin and hemicellulose), and vigorous research continues to explore what sort of pretreatment methods most efficiently separate it out before the depolymerization is conducted. Approaches range from the application of acids or bases to microbial digestion. Ray *et al.* now show that a 3- to 4-week treatment of sapwood from pine trees with brown rot fungi—specifically, *Coniophora puteana* and *Postia placenta*—significantly enhances the subsequent release of sugars by cellulose enzymes. Controls with other types of fungi proved less effective, bolstering previous findings that brown rot may be a boon for woody biomass processing. — JSY

Biomass Bioenergy **34**, 10.1016/j.biombioe.2010.03.015 (2010).